

**Eurokoodeks 3: Teraskonstruksioonide
projekteerimine. Osa 1-7: Põikkoormusega
plaatkonstruktsioonide projekteerimine**

Eurocode 3 - Design of steel structures - Part 1-7: Plated
structures subject to out of plane loading

EESTI STANDARDI EESSÕNA

NATIONAL FOREWORD

Käesolev Eesti standard EVS-EN 1993-1-7:2007 sisaldab Euroopa standardi EN 1993-1-7:2007 ingliskeelset teksti.

Standard on kinnitatud Eesti Standardikeskuse 31.05.2007 käskkirjaga ja jõustub sellekohase teate avaldamisel EVS Teatajas.

Euroopa standardimisorganisatsioonide poolt rahvuslikele liikmetele Euroopa standardi teksti kättesaadavaks tegemise kuupäev on 18.04.2007.

Standard on kättesaadav Eesti standardiorganisatsioonist.

This Estonian standard EVS-EN 1993-1-7:2007 consists of the English text of the European standard EN 1993-1-7:2007.

This standard is ratified with the order of Estonian Centre for Standardisation dated 31.05.2007 and is endorsed with the notification published in the official bulletin of the Estonian national standardisation organisation.

Date of Availability of the European standard text 18.04.2007.

The standard is available from Estonian standardisation organisation.

ICS 91.010.30, 91.080.10

Standardite reprodutseerimis- ja levitamiseõigus kuulub Eesti Standardikeskusele

Andmete paljundamine, taastekitamine, kopeerimine, salvestamine elektroonilisse süsteemi või edastamine ükskõik millises vormis või millisel teel on keelatud ilma Eesti Standardikeskuse poolt antud kirjaliku loata.

Kui Teil on küsimusi standardite autorikaitse kohta, palun võtke ühendust Eesti Standardikeskusega:
Aru 10 Tallinn 10317 Eesti; www.evs.ee; Telefon: 605 5050; E-post: info@evs.ee

Right to reproduce and distribute Estonian Standards belongs to the Estonian Centre for Standardisation

No part of this publication may be reproduced or utilized in any form or by any means, electronic or mechanical, including photocopying, without permission in writing from Estonian Centre for Standardisation.

If you have any questions about standards copyright, please contact Estonian Centre for Standardisation:
Aru str 10 Tallinn 10317 Estonia; www.evs.ee; Phone: +372 605 5050; E-mail: info@evs.ee

English Version

Eurocode 3 - Design of steel structures - Part 1-7: Plated structures subject to out of plane loading

Eurocode 3 - Calcul des structures en acier - Partie 1-7:
Résistance et stabilité des structures en plaques planes
chargées hors de leur plan

Eurocode 3 - Bemessung und Konstruktion von
Stahlbauten - Teil 1-7: Plattenförmige Bauteile mit
Querbelastrung

This European Standard was approved by CEN on 12 June 2006.

CEN members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration. Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the CEN Management Centre or to any CEN member.

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CEN member into its own language and notified to the CEN Management Centre has the same status as the official versions.

CEN members are the national standards bodies of Austria, Belgium, Bulgaria, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland and United Kingdom.



EUROPEAN COMMITTEE FOR STANDARDIZATION
COMITÉ EUROPÉEN DE NORMALISATION
EUROPÄISCHES KOMITEE FÜR NORMUNG

Management Centre: rue de Stassart, 36 B-1050 Brussels

Content**Page**

Foreword	3
1 General.....	4
1.1 Scope	4
1.2 Normative references.....	4
1.3 Terms and definitions	5
1.4 Symbols	6
2 Basis of design	9
2.1 Requirements	9
2.2 Principles of limit state design.....	9
2.3 Actions.....	9
2.4 Design assisted by testing.....	10
3 Material properties.....	10
4 Durability.....	10
5 Structural analysis	10
5.1 General	10
5.2 Stress resultants in the plate.....	10
6 Ultimate limit state.....	15
6.1 General	15
6.2 Plastic limit.....	15
6.3 Cyclic plasticity	16
6.4 Buckling resistance.....	17
7 Fatigue	18
8 Serviceability limit state	18
8.1 General	18
8.2 Out of plane deflection	18
8.3 Excessive vibrations	18
Annex A [informative] – Types of analysis for the design of plated structures	19
A.1 General	19
A.2 Linear elastic plate analysis (LA).....	19
A.3 Geometrically nonlinear analysis (GNA)	19
A.4 Materially nonlinear analysis (MNA).....	20
A.5 Geometrically and materially nonlinear analysis (GMNA).....	20
A.6 Geometrically nonlinear analysis elastic with imperfections included (GNIA)	20
A.7 Geometrically and materially nonlinear analysis with imperfections included (GMNIA).....	20
Annex B [informative] – Internal stresses of unstiffened rectangular plates from small deflection theory	21
B.1 General	21
B.2 Symbols	21
B.3 Uniformly distributed loading	21
B.4 Central patch loading.....	24
Annex C [informative] – Internal stresses of unstiffened rectangular plates from large deflection theory	26
C.1 General	26
C.2 Symbols	26
C.3 Uniformly distributed loading on the total surface of the plate	26
C.4 Central patch loading.....	32

Foreword

Foreword

This European Standard EN 1993-1-7, Eurocode 3: Design of steel structures: Part 1-7 Plated structures subject to out of plane loading, has been prepared by Technical Committee CEN/TC250 « Structural Eurocodes », the Secretariat of which is held by BSI. CEN/TC250 is responsible for all Structural Eurocodes.

This European Standard shall be given the status of a National Standard, either by publication of an identical text or by endorsement, at the latest by October 2007, and conflicting National Standards shall be withdrawn at latest by March 2010.

This Eurocode supersedes ENV 1993-1-7.

According to the CEN-CENELEC Internal Regulations, the National Standard Organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Bulgaria, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland and United Kingdom.

National annex for EN 1993-1-7

This standard gives alternative procedures, values and recommendations with notes indicating where national choices may have to be made. The National Standard implementing EN 1993-1-7 should have a National Annex containing all Nationally Determined Parameters to be used for the design of steel structures to be constructed in the relevant country.

National choice is allowed in EN 1993-1-7 through:

- 6.3.2(4)

1 General

1.1 Scope

(1)P EN 1993-1-7 provides basic design rules for the structural design of unstiffened and stiffened plates which form part of plated structures such as silos, tanks or containers, that are loaded by out of plane actions. It is intended to be used in conjunction with EN 1993-1-1 and the relevant application standards.

(2) This document defines the design values of the resistances: the partial factor for resistances may be taken from National Annexes of the relevant application standards. Recommended values are given in the relevant application standards.

(3) This Standard is concerned with the requirements for design against the ultimate limit state of:

- plastic collapse;
- cyclic plasticity;
- buckling;
- fatigue.

(4) Overall equilibrium of the structure (sliding, uplifting, overturning) is not included in this Standard, but is treated in EN 1993-1-1. Special considerations for specific applications may be found in the relevant applications parts of EN 1993.

(5) The rules in this Standard refer to plate segments in plated structures which may be stiffened or unstiffened. These plate segments may be individual plates or parts of a plated structure. They are loaded by out of plane actions.

(6) For the verification of unstiffened and stiffened plated structures loaded only by in-plane effects see EN 1993-1-5. In EN 1993-1-7 rules for the interaction between the effects of inplane and out of plane loading are given.

(7) For the design rules for cold formed members and sheeting see EN 1993-1-3.

(8) The temperature range within which the rules of this Standard are allowed to be applied are defined in the relevant application parts of EN 1993.

(9) The rules in this Standard refer to structures constructed in compliance with the execution specification of EN 1090-2.

(10) Wind loading and bulk solids flow should be treated as quasi-static actions. For fatigue, the dynamic effects must be taken into account according to EN 1993-1-9. The stress resultants arising from the dynamic behaviour are treated in this part as quasi-static.

1.2 Normative references

(1) This European Standard incorporates, by dated or undated reference, provisions from other publications. These normative references are cited at the appropriate places in the text and the publications are listed hereafter. For dated references, subsequent amendments to or revisions of any of these publications apply to this European Standard only when incorporated in it by amendment or revision. For undated references the latest edition of the publication referred to applies.

EN 1993	Eurocode 3: Design of steel structures:
Part 1.1:	General rules and rules for buildings
Part 1.3:	Cold-formed members and sheeting
Part 1.4:	Stainless steels
Part 1.5:	Plated structural elements

- Part 1.6: Strength and stability of shell structures
- Part 1.8: Design of joints
- Part 1.9: Fatigue strength of steel structures
- Part 1.10: Selection of steel for fracture toughness and through-thickness properties
- Part 1.12: Additional rules for the extension of EN 1993 up to steel grades S700
- Part 4.1: Silos
- Part 4.2: Tanks

1.3 Terms and definitions

- (1) The rules in EN 1990, clause 1.5 apply.
- (2) The following terms and definitions are supplementary to those used in EN 1993-1-1:

1.3.1 Structural forms and geometry

1.3.1.1 Plated structure

A structure that is built up from nominally flat plates which are joined together. The plates may be stiffened or unstiffened, see Figure 1.1.

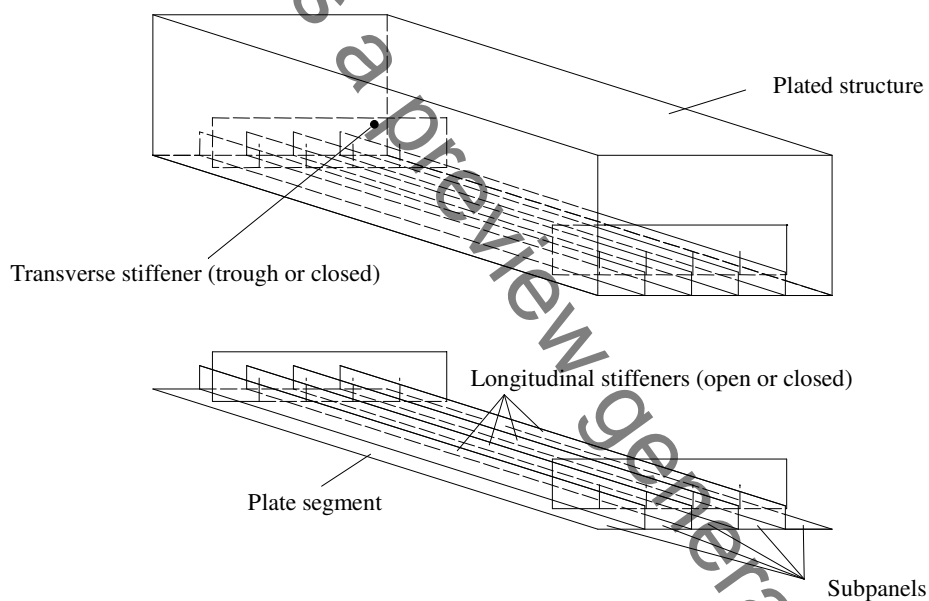


Figure 1.1: Components of a plated structure

1.3.1.2 Plate segment

A plate segment is a flat plate which may be unstiffened or stiffened. A plate segment should be regarded as an individual part of a plated structure.

1.3.1.3 Stiffener

A plate or a section attached to the plate with the purpose of preventing buckling of the plate or reinforcing it against local loads. A stiffener is denoted:

- longitudinal if its longitudinal direction is in the main direction of load transfer of the member of which it forms a part.
- transverse if its longitudinal direction is perpendicular to the main direction of load transfer of the member of which it forms a part.